h7 Mesozoic echinoids < Rowe; infaunal >

Echinoderms (Phylum Echinodermata) include exclusively marine "spiny skinned" animals: echinoids (sand dollars, sea urchins), asteroids (brittle stars, starfish), concentricycoids (sea daisies), crinoids (feather stars, sea lilies), and holothuroids (sea cucumbers).[1]

Only the calcareous plates of the endoskeleton (internal skeleton) of an echinoid are usually fossilized. These hard parts have a unique meshwork structure and exhibit single-crystal calcite cleavage (an astonishing feature unique to the phylum). Also unique for animals with a complete digestive tract, and bilaterally symmetrical larvae, is an adult body plan with a nearly radial and a characteristically five-fold (pentamerous) symmetry.

Living sand dollars are circular thin-biscuit shaped echinoids. They are infaunal. That is, they graze *in* sediments and not *on* rock surfaces (as do spiny sea urchins). Mesozoic ancestors to the sand dollars were also infaunal but were bilaterally-symmetrical, chubby, irregular heart-shaped echinoids.

A succession fossil heart-shaped echinoids, genus *Micraster* described from Cretaceous chalk strata (***Figure h7.1***): Evidence of progressive change in which the mouth migrated toward the animal's front and the anus migrated toward its rear was noted by C. J. A. Meyer in 1878 and in 1899 Arthur Walter Rowe (1858-1926) claimed for a similar sequence both speciation and "gradualistic" evolutionary adaptation to infaunal living.[2] Lovely though these descriptions be, the stratigraphically ordered succession is not incontrovertible proof of gradualism for, as Andy Gale reminds: "chalk sedimentation was intermittent, and that, rather than representing a single constant environment, chalk was deposited in a diverse mosaic of facies controlled by factors such as surface water productivity and current activity. Many of these facies have characteristic and highly restricted faunas."[3] What Rowe "actually had," writes Niles Eldredge, "was a series of closely related species—some of which were possibly related in an ancestral-descendant fashion—that nonetheless do *not* show the long periods of gradual change taking one species into another through the passage of geological time." [4] ❑

Figure ***h****7.1* [2]
Progressive change in *Micraster*

Rowe's figure (right) indicating divergent speciation.

Meyer's figure (below) that indicates the changing relative positions of mouth and apical disk by lines a-a, b-b, etc.